

3. On some Recent Corals from Madeira. By Prof. P. MARTIN DUNCAN, M.B. (Lond.), F.R.S., Pres. Royal Micros. Soc., &c. (Communicated by the Secretary.)

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(Plate VIII.)

In the autumn of 1881, Mr. J. Y. Johnson, of Madeira, sent me a small collection of Corals which he had obtained, from a few fathoms depth, in the sea off Funchal and other places near the island. Some of the specimens were adherent by their bases to a small species of oyster, and others to the bases of Gorgonidæ. As the collection has species in it representing the Mediterranean, Floridan, and North-Atlantic deep-sea coral-faunas, I thought that its description would be of some importance. The new species are three in number; and two of them are very interesting. One, *Ceratotrochus johnsoni*, belongs to a genus which has a recent species on the American side of the Atlantic and fossil forms in the Mediterranean Pliocene and Miocene and in the Australian Miocene strata. Another, *Caryophyllia endothecata*, reveals a decided interseptal structure like the endotheca of the family Astræidæ.

Description of the Species, and Remarks.

MADREPORARIA.

Section *APOROSA*.

Family TURBINOLIIDÆ.

Subfamily *Caryophyllinæ*.

Genus *CARYOPHYLLIA*, Milne-Edwards & Haime.

This genus and its divisions were noticed at some length in the description of the Madreporaria dredged up during the expedition of H.M.S. 'Porcupine,' published in the 'Transactions' of the Society, vol. viii. pt. v. 1873. It is not necessary, therefore, to recapitulate, and especially as there has been no increase of knowledge on the subject of any importance since that date.

There are some fine specimens from Madeira of a species of *Caryophyllia* which was not obtained during the 'Porcupine' expedition, but which is a very well-known Mediterranean form. The specimens came up in deep water off Madeira, attached to a valve of *Ostrea cochlea*, which, in its turn, rested upon a hexactinellid sponge. One specimen was mature; a second was smaller; and there were two very small individuals. The larger specimen has the parts above the base perfect; but *Cliona*-borings have destroyed the broad base of attachment.

Caryophylliæ with more than four perfect cycles of septa.

CARYOPHYLLIA CYATHUS, Lamarck, Syst. des Anim. sans vertèb., 1801.

The corallum is tall, slightly bent, subturbinate, slightly compressed, and has a base much narrower than the calicular opening. The costæ are only distinct for a short distance from the calice; and then they become flat and only occasionally visible, being separated by indistinct lines and ornamented by numerous small granules which are placed across the costæ. The whole surface is, as it were, shining and varnished-looking; near the base the costæ are not visible, but the granulations and varnished appearance prevail.

The calice is longer than broad, elliptical in outline, very deep centrally and shallow at the margins. Some of the septa are slightly exsert, but they do not project much higher than the others; and this is the case with the primaries and other large septa which have no pali before them. The septa are close, stout, and unequal, and there is but little space between them; they are rounded at their upper edge and towards the columella; they are straighter and some are rather large internally. There are many septa of the fifth cycle.

The columella is deeply sunken, fasciculate, elliptical in outline, rounded above, and composed of eleven processes well separated. The pali are higher than the columella, stout, and as large as the ends of the septa to which they belong, and from which they are well separated above. There are eighteen of them; and they are separated by a space from the columella.

The height of the coral is $1\frac{1}{16}$ inch, and the length of the calice $\frac{5}{8}$ inch, its breadth being $\frac{9}{16}$ inch.

This description corresponds specifically with that of MM. Milne-Edwards and Jules Haime in their Hist. Nat. des Corall. vol. ii. p. 13. The columella, however, has fewer processes; but it is found that there is much variation in that structure in specimens from the Mediterranean, some of which have the same number as the Madeiran form.

A smaller specimen has a widely open calice, the columella deeply seated, and the septa barely exsert. The columella is made up of about five twisted processes. The pali are thin, separate, and eighteen in number; they have granules with little cup-shaped cavities in them, and are much higher than the columella, from which they are well separated above. They are wavy at the edges. The septa, thin and not over close, are wavy here and there at their inner edge, and are granular at the sides.

The calice is more circular than that of the larger form; and the body is shorter. Height $\frac{3}{4}$ inch.

This form can be comprehended by studying sections of larger and mature forms made near their bases. There the granular and more or less distant septa hardly seem possibly to belong to a coral which could develop such a close-set septal arrangement as is seen above.

Both these specimens came from off the same shell.

A smaller individual of this species presents the peculiar ornamentation of the costæ near the calice and the shining epitheca. It is cylindrical in shape, and is just beginning to curve at the top; and it is fixed, by a base with two small offshoots, within the hollow of the valve of a shell. The calice is widely open, but has sharp margins and very slender and somewhat exsert and tolerably bent primary and secondary septa.

The primaries and secondaries are nearly equal; the tertiaries are much smaller; and the fourth and fifth orders of the fourth cycle of septa are very small. The larger septa are wavy within, very slender, and well separated.

The columella occupies considerable space, and is composed of about eight twisted band-like lamellæ, which are separate.

The pali are very small, and closely resemble the trabeculæ of the collumella; but their union low down with the septa can sometimes be seen. They are before the second and third orders of septa. The corallum is excessively slender and transparent.

Height of the coral $\frac{5}{16}$ inch.

At the base of the specimen just described, and within the same valve of a shell, is a very minute coral, which appears to be a still smaller form of *Caryophyllia cyathus*. It has a circular calice, six primary and six smaller or secondary septa; and there are twelve very small rudiments of the tertiary cycle. The larger septa are slightly enlarged at their inner ends; and there are no pali, the columellary trabeculæ being very small and apparently in one little bundle.

It is evident from the study of these specimens that the peculiar shining costal covering which has been termed a pellicular epitheca, but which does not appear to be a true outer thecal covering, is always present. The thickness of the septa and their crowded state seen in the adults is a matter of growth; and it is clear that the first stage of the coral shows three cycles of septa, the tertiary being rudimentary, and that in a more advanced stage there are four perfect cycles. The full number of septa is obtained during adult age; and the whole of the calcareous tissues increase then in thickness.

In examining some pieces of worn coral, probably originally forming part of a large *Dendrophyllia*, I found a small *Caryophyllia cyathus*. It has the peculiar epitheca, and is just in advance of the smallest specimen just noticed, so far as its growth is concerned.

There are four cycles of septa in some of the systems, and in the others only three. The columella is a twisted piece of tissue; and the pali are small but distinct and are before the secondaries.

Hence the coral with three cycles of septa in its early stage has no pali; they appear before the secondaries a little later, and subsequently before the tertiary; and this takes place when the fourth and fifth orders of septa are complete in a system. Then pali are developed before a higher order and eighteen result. The pali are deep in the calice, but project upwards; and they send processes

inwards to join the twisted trabeculæ of the columella. The septa are marked low down by oblique rows of granules; but there is not a trace of any endotheca.

CARYOPHYLLIA CLAVUS, Scacchi, var. *TINCTA*.

The common British shallow-water coral is represented by a form at Madeira which cannot be separated from it specifically. Indeed it seems to be a simple variety, having a small columella, fewer septa, smaller pali; and the tint of the columella is pearly white, whilst that of the septa and costæ is reddish brown. The British variety *smithi* of Stokes is white, and is found below tide-mark in Devonshire.

The corallum is short, with a broad incrusting base, an epitheca reaching far towards the margin; there are well-developed granular costæ above the epitheca, some projecting, and four complete cycles of septa with some orders of the fifth. The calice is deep, slightly elliptical in outline; and the columella is small, elongate and narrow, and is formed of a few tall twisted ribbon-shaped processes. The primary septa are exsert; and the secondaries are less so. The pali are small, and are before the third cycle of septa.

The granulation of the sides of the septa is in arched rows, one above the other; and the lateral projection of the granules from the free inner ends of the septa is decided.

Length of the calice $\frac{2}{3}$ inch.

Subdivision *CARYOPHYLLIÆ ENDOTHECATÆ*.

Amongst this collection of corals from Madeira is one which, whilst it presents all the characters of the genus *Caryophyllia*, possesses a distinct endotheca between its septa, occluding more or less the interseptal loculi here and there.

It is a most important form, especially when it is considered in relation to *Asterosmia*, a genus of Trochocyathacæ or Caryophylliæ with a double row of pali, and possessing endothecal dissepiments; for the possession of an endotheca has been considered to be of sufficient classificatory value to place genera with and without it in different families.

I propose including the new form amongst the species of *Caryophyllia*, giving it a subgeneric position.

CARYOPHYLLIA ENDOTHECATA, sp. nov. (Plate VIII. figs. 1-4.)

The coral is small, with a broad flat base, from which rises a more or less cylindrical body slightly constricted above the base, and narrowed and reentering at the calicular margin somewhat.

The calice is circular in outline, rather shallow near the margins, but much deeper at the columella, which consists of four or five distinct nodules. The septa are unequal, well apart, slightly exsert according to the order, and dip down, not reaching the columella. They are thin, slightly wavy in some instances; and the size of the primaries and secondaries distinguishes them. There are four cycles of septa in five systems and in one half of the sixth; but in

the other half the higher orders are not developed. The pali follow the ordinary rule, and are before the tertiary septa in all systems where the higher orders are fully developed; and consequently there are eleven long, narrow, wavy, very distinct, and well-developed pali.

There is a decided endotheca just within the margin, whose edge is somewhat inverted; and it covers some of the pali and occludes several interseptal loculi. In other parts dissepiments may be seen stretching between the septa. The costæ are numerous at the base, and are in lines of granules or in faint ridges. Near the calice the costæ of the larger septa are the most projecting; and all are marked with granules, which, in some instances, assume a serpentine arrangement. There are faint traces of a pellicular epitheca.

Height of coral $\frac{5}{16}$ inch, length of calice $\frac{3}{8}$ inch.

From Madeira.

Subfamily *Trochocyathaceæ*.

Genus PARACYATHUS, Milne-Edwards & Haime, 1848.

PARACYATHUS STRIATUS, Philippi, sp.

Several specimens of this widely-distributed form, with unlobed pali and well-developed costæ, are from Madeira. The species is common in the Mediterranean and in the Caribbean Sea.

Subfamily *Turbinolinæ*.

There are four specimens of a simple coral in the collection from Madeira, which were dredged at a depth of 30 fathoms in Funchal Bay; and they represent three stages of the growth of the species.

Genus CERATOTROCHUS, Milne-Edwards & Jules Haime, 1848.

CERATOTROCHUS JOHNSONI, sp. nov. (Plate VIII. figs. 5-8.)

The coral is horn-shaped, bent, and has several growth-rings on it; it was attached by a narrow circular base, which has broken from its support. The calice is wider than the rest of the body, is almost circular in outline, and its marginal wall is thin. The axial space is wide and deep; the septa are thin, wide apart, and rather bent; they are unequal, very slightly exsert, and do not reach far into the calice except in the instance of the larger ones. There are several quite rudimentary septa in some parts of the calice; but they correspond to costæ which are much larger in every respect. Omitting these, the septa are twenty-seven in number, and counting them, are forty-four in all. The arrangement in cycles is irregular; and there appear to be five primaries only. The margin between the septa has a festooned edge; and the interseptal spaces are wide. It is at the lowest point of the concavity of the festoon that the minute septa arise. The tertiary septa are smaller than the secondaries, and they project well from the wall and reach down into the depths of the calice. The septa are rounded above; their edge is rather straight within; and they are sometimes bent; and

their sides are ornamented with very decided elevations and depressions, forming series of close arches, the convexity being upwards and slightly inwards. The small size of the origin of the septa from the broad costæ is sometimes evident.

The columella is small and very deeply situate, and is formed by four or five lax trabeculæ, which unite with some of the septal ends.

The costæ differ considerably near the base and close to the calice. Near the base they are not numerous; and in some parts they are slightly developed, subequal or alternately large and small, distinct, and either subcristiform or marked with a row of long, narrow, flat, separate elevations or granules, whilst in others they are alternately large and small, and the intercostal tissue is granular. In the middle of the outside of the coral the costæ are larger, subequal, and subcristiform, thin and wavy, and alternately broader, flatter, and granular. Close to the calice they become more numerous, cristiform, wavy and oblique, and subequal, the intercostal areas being minutely granular.

The fractured base shows a thick wall, a columellary tissue, and twelve irregular and short septa.

The length of the coral is $\frac{7}{8}$ inch, and the length of the calice is $\frac{1}{4}$ inch.

A second and smaller specimen with the same external shape and prevailing decided growth-rings, is younger than that just described. The septa have all the characteristics of those of the first specimen; but the rudimentary ones are absent; their costæ exist however.

There are not three complete cycles; and the interseptal loculi are very broad.

The columella is deeply seated, and is formed by tissue, coming irregularly from the ends of some septa. The rough ridges of the sides of the septa are very evident.

The costæ are very distinct, but, as in the other specimen, small; and their characteristic is their narrow wavy crest near the calice, and their broader and granular nature near the base.

The fractured base shows nine septa, some primaries and the others secondaries; but it is not possible to define them.

Height of the coral $\frac{3}{4}$ inch, length of the calice rather less than $\frac{1}{4}$ inch.

The other two specimens are young, and their curved form has only just commenced; they have three perfect cycles of septa, and a small columella deeply seated. The costæ of one are broadly granular and subequal near the base; and near the calice they become shorter, with a tendency to a wavy cristiform shape here and there. In the other the costæ are decidedly wavy and crested near the calice and lower down near a growth-ring, and then to the very base. In one instance the base has become incrustated by a Bryozoon.

Height of coral $\frac{7}{16}$ inch.

As regards the negative characters, it may be said that there are no pali, and that the endotheca is deficient; moreover the epitheca is only faintly indicated in a young form. The columella is smaller than in the species typical of the genus. The positive characters

are the costal ornamentation and distribution, the large interseptal loculi, the small columella, and the very marked curved ridges on the sides of the septal laminæ.

Family OCULINIDÆ.

Subfamily *Stylophorinæ*.

Genus MADRACIS.

MADRACIS ASPERULA, Milne-Edwards and Jules Haime, 1850.

This well-known Madeiran coral is in the collection; and the specimen shows calices with eight, nine, and ten septa.

The range of the species is considerable; for it was found by Pourtales on the other side of the Atlantic.

Subfamily *Oculinaceæ*.

Genus AMPHIELIA, Milne-Edwards and Jules Haime, 1849.

AMPHIELIA OCLATA, Linn. sp.

A small fragment of this coral was found with one of a variety of

AMPHIELIA RAMEA, Sars.

Family ASTRÆIDÆ.

Subfamily *Cladocoraceæ*.

Genus CLADOCORA, Ehrenberg, 1834.

CLADOCORA DEBILIS, Milne-Edwards and Jules Haime, 1849.

Specimens of this common Madeiran coral were sent by Mr. Johnson, and do not present any new points of interest.

Section *PERFORATA*.

Family MADREPORIDÆ.

Subfamily *Eupsamminæ*.

Genus BALANOPHYLLIA, Searles Wood.

BALANOPHYLLIA BREVIS, sp. nov. (Plate VIII. figs. 9-12.)

The corallum is short, compressed in the direction of its length somewhat, with an elliptical deep calice, a broad, flat, attached base, and a small, very deeply-seated, elongate trabecular columella, flat on its surface, and united to the septa by six small processes. The epitheca is dense, reaches close up to the calicular margin, and ends there in a definite linear ridge. The septa are in six systems; and in four of them there are five cycles, whilst in the others there are three cycles and one half of the fourth, the septa of the higher order being developed between the primary and tertiary septa only. The laminæ are stout, very granular, and subspinulose, and more ragged, even on the edges, curved above, where they occupy much space on the edge of the calice, and dipping down suddenly on all sides of the large, elongate, and deep axial space. The septa are very

unequal in length and size. This produces a festooning of the margin of the calice, the primaries being the highest and the septa next to them only slightly lower. The secondaries are high, but lower than the primaries; and they have a higher order of septa next to them just below their elevation. The lowest point of the calicular edge is over the tertiary septa, which are the smallest. The six primary septa are well developed and are free¹, and do not reach the columella, but pass lower by its side to the base. The secondaries of four systems are next in size to the primaries and are free at their inner ends and straight; but in two systems, where the fourth cycle is incomplete, they unite with a process of the septa placed next to the primaries by a process which reaches, after junction, a radiating projection of the columella.

The tertiary septa are the smallest and are free, being included in the loops formed by the higher septa in their junction with each other and the columella.

The septa of the fourth and fifth orders, in four of the systems, unite in front of the tertiary septa; and thence a process passes in front of the secondary to reach one from the columella. These processes are continuations of the septal edges, and also of columellary structure, and are stout and well separated.

The costæ are visible at the margin before they are covered with the epitheca. They are very sharply granular and unequal.

The tint of the coral is brownish red, the columella being white.

Height of the coral $\frac{1}{4}$ inch, length of calice not quite $\frac{5}{8}$ inch, breadth of calice $\frac{1}{4}$ inch, length of base $\frac{1}{4}$ inch.

Locality. Madeira.

The smaller specimen has the epitheca more distant from the calicular edge, a more defined columella ornamented with a few spiny granules on its surface, the same number of septa in the four systems, and a large deep axial space.

This small Balanophyllian has its specific characters well marked, and has not hitherto been noticed. It is probably a young form; and certainly, although it has the characters of the genus, the walls are imperforate. Probably it is the growth of the coral that decides this.

List of the Corals dredged from Madeira.

<i>Caryophyllia cyathus</i> , Lamarck.	<i>Madracis asperula</i> , Edw. & Haime.
— <i>clavus</i> , Scacchi.	<i>Amphihelia oculata</i> , Linn. sp.
— <i>endothecata</i> , sp. nov.	— <i>ramea</i> , var., Sars.
<i>Paracyathus striatus</i> , Philippi, sp.	<i>Cladocora debilis</i> , Edw. & Haime.
<i>Ceratotrochus johnsoni</i> , sp. nov.	<i>Balanophyllia brevis</i> , sp. nov.

The presence of *Caryophyllia cyathus* and *Caryophyllia clavus* in the sea of Madeira was almost to be expected, and that of *Paracyathus striatus* also, they all being Mediterranean forms and Atlantic also. The *Madracis* is found also on the American side of the

¹ In one instance there is a faint union with the columella.

